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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/039,438	03/16/1998	WOO-SUP SHIN	041992-5037	9576

30827 7590 04/08/2005

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EXAMINER	
ZERVIGON, RUDY	

ART UNIT	PAPER NUMBER
1763	

DATE MAILED: 04/08/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/039,438	SHIN ET AL.	
	Examiner	Art Unit	
	Rudy Zervigon	1763	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *18 January 2005*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-26* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-26* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

2. Claims 1, 2, 7, 10, 11, 13, 14, 17-22, 25, and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nelson (U.S.Pat. 4,147,581) in view of Chung et al (U. S. Pat. No. 5,000,795), Kanda (U.S.Pat. 4,338,157), and Allies, Victoria R. et al (U.S.Pat. 5,560,838). Nelson discloses an etching process and apparatus for chemically etching[1] (reduction in thickness) material from a substrate (column 1, lines 40-68; Figure 1). An etched product ("solid"; column 4, lines 40-50) is etched in unit 2 (Applicant's "first tank" Figure 1) thereby at least contacting the solid with the aqueous liquid (first etchant – "etching solution"; column 4, line 43; column 2, lines 45-69) including HF (abstract) and the resulting liquid (residual etchant of stream 3, Figure 1; column 4, lines 58-60) is passed through an ion exchanger (11, Figure 1; "separation tank"; column 4, line 67-column 5, line 16) to remove the ions from the rinse liquid which is reused or discharged (30, 16; Figure 1). The solids (residue materials) are removed from an etcher ("etch bath") (2) via a stream (3) which passes into a rinse chamber (a second tank; 4; Fig. 1; col. 4, lines 49-68) including outlet pipe (6; column 4, lines 55-57). The rinse liquid stream (7) then goes through an ion exchanger means (11). A replenishing solution (30) from the ion exchange means is combined (31) with the stream (22) of a bulk storage tank (20; 1st Tank; column 5, lines 35-40) to form a combined stream (31) going to the etcher (2; col. 5, lines 35-55). The bulk storage tank (20) has streams flowing to the etcher (2) for etching the product and

to the ion exchange means (11) in order to regenerate the resin. Stream (12) from the ion exchanger (11) moves to a discharge stream (16), which passes to a sewer. (Col. 5, lines 5-10). The etcher (2) can be a spray etcher which would inherently have nozzles (col. 4, line 40).

Nelson does not disclose an immersion of a substrate in an etched bath or a bubble plate used therein.

Chung et al disclose a bubble plate (17) located on the floor of a tank (10; Fig. 1). The bubble plate (17) transmits inert gas to create a bubbling condition within the tank (10) for sufficient agitation (col. 1, lines 60-68). Silicon substrates (14; column 3, lines 44-48) are immersed in an etch bath ("hot sulfuric acid"; 13; Fig. 2; col. 2, lines 25-38; column 3, lines 44-48).
At the time of the invention it would have been obvious to a person of ordinary skill in the art to replace the spray etcher of Nelson with the etch bath and bubble plate of Chung et al.
The motivation for doing so would be to replace the etchant delivery means (ie, sparger etcher) with an alternate and equivalent etching means (ie a bath etcher).

Nelson and Chung et al do not teach a temperature sensor and control unit.
Kanda et al disclose a process control system (45, 47-57; Figure 10; column 9, line 12 – column 10, line 47) having a thermocouple for measuring the temperature of the etching solution (8, Figure 2; column 9, lines 22-23) used to etch a submerged substrate (2, Figure 3). Kanda specifically teaches a control unit (45, 47-57; Figure 10; column 9, line 12 – column 10, line 47)

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[1] Etch – 1a: to produce (as a pattern or design) on a hard material by eating into the material's surface (as by acid or

for receiving a signal indicating the temperature (T) of the etchant from a temperature sensor ("thermocouple") and transmitting an etching termination signal (P _ 0) to the etch bath when the temperature reaches a target temperature. Further, Kanda teaches the etched thickness (Q; column 10, lines 10-15) of the substrate is derived from the temperature (T) of the first etchant.

Nelson, Chung, and Kanda do not teach using the total reaction energy as a reference. Nelson, Chung, and Kanda do not teach a controller that controls the first tank, the etch bath and the second tank. Nelson, Chung, and Kanda do not teach using gravity (i.e. weight) for separating the diluted etchant from the residual material.

Allies teaches a controller (340; Figure 3; column 3, lines 55-60) that controls the volume of fluid within numerous process tanks (column 3, lines 58-67), including controlling the temperature of said tank(s) (column 3, lines 58-67) resulting from numerous input signals (column 4, lines 1-10). Allies further teaches teach using gravity (i.e. weight) for separating the etchant ($CuCl_2$ etchant – column 3, lines 37-40) from residual material by mass/material filtration in filtration tank 338, Figure 3 – column 5, line 64 - column 6, line 5

At the time of the invention it would have been obvious to a person of ordinary skill in the art to control the etching operation for the etching apparatus of Nelson with the chemical processing control system of Kanda and Allies including using the total reaction energy as a reference by replacing Kanda's temperature in any of Kanda's "Q" equations (column 10) with "reaction energy" as derived from the well know thermodynamic relationship between molar enthalpy (per unit mass), heat capacity, and temperature[2]:

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laser beam). Merriam-Webster's Collegiate Dictionary - 10th Ed. p.398

[2] As demonstrated (MPEP 2116.01) in Physics for Scientists & Engineers, 2nd Ed. R.A. Serway, Saunders College Publishing, 1986. pp. 428 (see top-most equation).

$$\frac{\partial H}{\partial T} \equiv c_p$$

The motivation for controlling the etching operation for the etching apparatus of Nelson and Chung et al with the chemical processing control system of Kanda and Allies, using "reaction energy", would have been to detect the termination of etching appropriately and precisely as taught by Kanda (column 10, lines 44-47) by an alternate a equivalent means of detecting said termination in using "reaction energy".

At the time of the invention it would have been obvious to a person of ordinary skill in the art to add Allies's mass/material separation filtration tank to Nelson's processing system.

The motivation to add Allies's mass/material separation filtration tank to Nelson's processing system is to further purifying the recycled spent etchant solution as taught by Allies (column 5, line 64 - column 6, line 5).

Therefore, it would have been obvious to a person of ordinary skill in the art to combine Nelson with Chung et al and Kanda to obtain the invention.

3. Claims 3-6, 8, 9, 12, 15, 23, and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nelson (U.S.Pat.4,147,581) in view of Chung et al (U.S.Pat.5,00,795), Kanda (U.S. Pat. No. 4,886,590), and Allies, Victoria R. et al (U.S.Pat. 5,560,838), and further in view of Jones et al (U.S. Pat. No. 3,869,313).

Nelson, Chung, Kanda, and Allies are discussed above.

Nelson, Chung, Kanda, and Allies do not disclose expressly a rinse and drying bath for the substrate.

As to claims 3-5, 8, 9, and 12, Jones et al disclose a chemical processing apparatus containing a plurality of treatment chambers having a dip chamber with filling pumps, a spray chamber which

serves as a rinse chamber or a drying chamber (col. 2, lines 20-39 and 63-68; col. 3, lines 1-10). The rinse chamber would be filled with deionized water from a deionized reservoir (col. 2, lines 52-55). An essential part of the apparatus is a conveyor means for automatically transferring the workpieces from treatment chamber to treatment chamber. (Fig. 1; Col. 3, lines 50-55). The conveyor allows for a plurality of substrates to be processed substantially at the same time. Using a pump to move fluid from one chamber to another is conventional. Jones further teaches a Acontrolled heater 67" (column 2, lines 28-35) used in the Atreatment≅ chamber that Amay be used as a drying chamber≅ (column 3, lines 1-3).

As to claim 6, Jones et al disclose a cleaning/etching solution containing hydrofluoric acid (col. 5, lines 49-60; col. 6, lines 33-35 and 51-54). Jones et al disclose cone shaped bottom tanks (Figs. 6A-B).

At the time of the invention it would have been obvious to a person of ordinary skill in the art to combine the multiple chambers for rinsing and drying of Jones et al with the etching apparatus of Nelson, Chung et al, and Kanda.

The motivation for doing so would have been to provide treating operations such as rinsing and drying of substrates as taught by Jones et al.

4. Claim 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over Nelson (U.S.Pat. 4,147,581) in view of Chung et al (U. S. Pat. No. 5,000,795), Kanda (U.S.Pat. 4,338,157), and Allies, Victoria R. et al (U.S.Pat. 5,560,838), and further in view of Tittle (USPat. 4,886,590). Nelson, Chung, Kanda, and Allies are discussed above. However, Nelson, Chung, Kanda, and Allies do not teach a concentration measuring device of the first etchant.

Tittle teaches a concentration ("characteristic"; column 1, lines 31-36; column 2, lines 17-22) measuring device ("sensors", "chromatograph"; column 1, lines 65-68).

It would have been obvious to one of ordinary skill in the art at the time the invention was made for Nelson, Chung, Kanda, and Allies to add a concentration measuring device as taught by Tittle to his endpoint detection system.

Motivation for Nelson, Chung, Kanda, and Allies to add a concentration measuring device as taught by Tittle to his process control system is for monitoring when the rinsing solution should be changed or cleaned (column 1, lines 39-41).

Response to Arguments

5. Applicant's arguments filed January 18, 2005 have been fully considered but they are not persuasive.

6. Applicant states:

"

For example, the Examiner asserted that the piping 7, 8, 30 and 31 of Nelson was equivalent to the claimed limitation of "a connecting passage directly connecting the first and second tanks and directly transferring the separated diluted etchant from the second tank to the first tank" despite the fact that Nelson discloses that the piping 7 and 8 is never utilized in conjunction with piping 30 and 31.

"

In response, the Examiner is unable to understand Applicant's position that certain pipes, namely 7/8 and 30/31, are not used "in conjuction". Does Applicant mean that said piping sets are

mutually exclusive? If so, the Examiner disagrees. If Applicant's cited pipes did not function "in conjunction" then Nelson's apparatus would cease to operate as Nelson intended. Indeed, all of Nelson's piping act in conjuction to perfrom Nelson's etching operations as discussed above.

7. Applicant further states:

"

In other words the material passed through pipe 7 is never passed through pipes 30 and 31 (See column 5, lines 17-68 of Nelson).

"

In reponse, Applicant's position is directly opposite to the teachings of Nelson as is clearly evident from the process flow arrows as detailed by Nelson's Figure 1.

8. In response to applicant's argument that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988)and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, the Examiner's position that at the time of the invention it would have been obvious to a person of ordinary skill in the art to replace the spray etcher of Nelson with the etch bath and bubble plate of Chung et al. The Examiner did state that motivation for is drawn to an alternate and equivalent etching means. An example of such alternate and equivalent means, such as the apparatus of Chung, is specifically discussed by Nelson:

"

Referring now to FIG. 1, the solid to be etched and having a surface of etchable material, e.g., a metal, passes via stream 1 into etcher 2, which is typically a spray etcher or other type of etcher such as a splash etcher or the like.

" (column 4; lines 35-45)

As a result, the Examiner's prior art references to both Nelson and Chung define the state of the art at the time Applicant's invention was made as exemplified by Nelson. The Examiner further believes that no "redesign" of Nelson's apparatus is necessary, as Applicant contends. Nelson's etcher 2, Figure 1 is a etcher containing an etching bath as shown in Figure 2. The Chung etcher (10; Figure 1) is also an etcher with a bath etching solution (13; Figure 1) but which also includes a bubble plate as discussed above for submersing the wafer to be cleaned. No "redesign" of Nelson's etcher is required with respect to the teaching of Chung. The combination would be obvious under replacement of etchers as supported by Nelson, or by adding Chung's bubbler plate to Nelson's etcher with an etching bath solution as supported by Chung.

9. Applicant states:

"

Furthermore, the Examiner points to Nelson's spray etcher 2 as being equivalent to the claimed first tank, then asserts that it would be obvious to replace the spray etcher with a bubble plate as disclosed by Chung. Accordingly, the Examiner incorrectly points to Nelson's spray etcher as being equivalent to both the first tank and the etch bath .

"

10. In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on

combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). Further, the Examiner sites the Examiner's prior action: "Nelson does not disclose an immersion of a substrate in an etched bath or a bubble plate used therein."

11. Applicant states:

"

..nowhere in Nelson is there any suggestion of the desirability of controlling the etching process based on the temperature of the etchant. Accordingly, absent proper motivation to modify the system of the Nelson, the rejection of claim 10 is improper.

"

In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). Further, the Examiner disagrees that Nelson would *not* want to control his etching apparatus *in view of* the teachings of Kanda et al who specifically discloses a process control system (45, 47-57; Figure 10; column 9, line 12 – column 10, line 47) used to etch a submerged substrate (2, Figure 3). Kanda specifies that optimization utilizing his process control controls variations among processing which is an improvement to process control even by skilled operators (column 1; lines 20-36). Further, it is well established that it would be obvious to those of ordinary skill in the art to optimize the operation of the claimed invention (In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980); In re Hoeschele , 406 F.2d 1403, 160 USPQ 809 (CCPA 1969); Merck & Co. Inc . v. Biocraft

Laboratories Inc. , 874 F.2d 804, 10 USPQ2d 1843 (Fed. Cir.), cert. denied , 493 U.S. 975 (1989); In re Kulling , 897 F.2d 1147, 14 USPQ2d 1056 (Fed. Cir. 1990), MPEP 2144.05).

12. Applicant states:

"

Nowhere in Kanda is there any disclosure or suggestion of determining a termination temperature, much less terminating the etching process once the termination temperature has been reached.

"

13. In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., "determining a termination temperature") are not recited in the rejected claims. Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993). Further, the Examiner believes the Kanada disclosure, as conveyed by the Examiner above, accurately and specifically meet Applicant's *claimed* requirements. Claim 10 only requires:

"

a control unit controlling the etch bath, the control unit connected to the temperature sensor for receiving a signal indicating a temperature of the etchant to terminate the etching when the temperature of the etchant reaches a termination temperature.

"

The Examiner interprits the above portion of claim 10 as the "control unit" terminates the etching when the temperature of the etchant reaches a termination temperature. There is nowhere a "determination" of a "termination temperature" by Kanda's controller.

Conclusion

14. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

15. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Examiner Rudy Zervigon whose telephone number is (571) 272.1442. The examiner can normally be reached on a Monday through Thursday schedule from 8am through 7pm. The official fax phone number for the 1763 art unit is (703) 872-9306. Any Inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Chemical and Materials Engineering art unit receptionist at (571) 272-1700. If the examiner can not be reached please contact the examiner's supervisor, Parviz Hassanzadeh, at (571) 272-1435.